

1

3,514,312

## PROCESS FOR COATING A METAL SURFACE

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4 Claims

### ABSTRACT OF THE DISCLOSURE

A process for making a plastic roller wherein a metallic cylindrical core is covered with a layer of hard plastisol material adjacent to the core and with a layer of relatively soft plastisol material on the outer surface. The process comprises applying an adhesive to the metal, heating the metal, applying a first layer of plastisol to allow the heated metal to gel a first layer of plastisol of minimum thickness of about  $\frac{1}{16}$  inch immediately adjacent to the adhesive surface, applying a second plastisol layer, and heating to cure the layers. As a modification, the heating of the metal may be omitted, whereby a highly thixotropic first layer of plastisol is applied to form a film of minimum thickness of  $\frac{1}{16}$  inch, a second relatively soft plastisol layer is applied, and the layers are cured by heating, which may be performed in a mold.

This application is a continuation-in-part of my previous application for patent Ser. No. 515,514, filed Dec. 3, 1965 now abandoned, entitled "Plastic Roller Covering."

This invention relates to the formation of a bond between a very soft vinyl chloride plastisol (over 100 phr. of plasticizer) to a metal substrate (example: a printing press roll) which requires a very soft working surface (12-50 Shore A durometer).

The resultant product formed by my new process is a metal substrate surface with an adhesive bonded to it, a layer of relatively hard plastic bonded to the adhesive, and a layer of softer plastic fused to and commingled with the intermediate layer of harder plastic.

The presently available primers for vinyl chloride plastisol function only at lower plasticizer levels (e.g. where in general the level is the same as, or less than, the resin content on a weight percentage basis in the plastisol). When the plasticizer level was raised appreciably (well over 1:1 with resin) it was found that satisfactory adhesion to a metal or other material substrate was not attained.

Some of the plastisols used had dry surfaces, some relatively tacky or oily surfaces, but in each case the adhesion was unsatisfactory.

One factor involved preventing adhesion with the higher plasticizer level was the excessive shrinkage involved.

A normal plastisol shrinks approximately 1% upon returning to atmospheric temperature from fusion temperature (350° F. to 400° F.) while the higher plasticizer level materials shrink 2-5% or more.

This excessive shrinkage would cause an otherwise satisfactory adhesive to fail, especially during the fusion cycle, when the adhesive is very soft and under attack from the solvent action of the overlying plasticizer. It was also found that during the fusion cycle, the plastisol, whether normally wet or dry surfaced, at atmospheric temperature, would have a tendency to become quite wet on the surface immediately after fusion and while still hot.

One attempt to solve this problem of lack of adhesion was to affix steel wool to the metal substrate by spot

2

welding, and then permeate the steel wool with the higher plasticizer level plastisol, and also deposit a layer of softer higher plasticizer level plastisol on the outside which is used in forming printing press rolls. The steel wool compensated for the lack of bond to the metal substrate.

The attached drawing illustrates my process diagrammatically for applying the combination hard and soft plasticizer to the surface of a metal substrate; such as a metal roller.

My solution to this problem is outlined in the following steps:

#### STEP 1

The metal surface of a roller R is first prepared in the normal manner of machining, sandblasting, acid or alkaline liquid cleaning, or by other recognized methods, to obtain a clean, rust and oil free, slightly roughened surface.

#### STEP 2

A coating of known adhesive, or primer (material A), normally used for standard vinyl chloride plastisol coating (under 100 phr. of plasticizer) is then applied to the metal surface. This coating is in liquid form, and may be applied by spraying, dipping or brushing thereon. Such coating is relatively thin such as would be deposited by a single dip of the surface into the liquid. It must, however, completely coat the surface. A suitable adhesive for this purpose is that disclosed in U.S. Pat. No. 2,891,876, dated June 23, 1959 to Kenneth L. Brown, entitled "Primers for Vinyl Chloride Resin Coatings," reference to which is hereby made.

#### STEP 3

The adhesive coated metal is then heated to above the gel temperature of plastisol (250° F. minimum), such heat being sufficient to partially polymerize the adhesive, and,

#### STEP 4

The adhesive coated metal member is immersed in a cold resin (material B), suspension while the metal is still heated. The coated metal should not be allowed to cool and then reheated before dipping it in the cold resin suspension.

Typical formulation for material B is as follows:

	Phr. (parts per 100 parts resin)
High molecular weight dispersion resin	100
Polymeric or monomeric plasticizer	60
Inert filler (CaCO <sub>3</sub> )	30
Epoxidized soya oil	5-10
Metallic stabilizer	2-5

The above may be modified by adding 2-10 parts of thixotroping agent per 100 parts resin, for purposes hereinafter mentioned.

The dispersion resin used in this part of the system should have an average molecular weight of at least 20,000 and may range over 100,000 without changing its function therein. Normally this is referred to as a vinyl homopolymer, but the resin portion may also contain ratios of a blending resin which may be a copolymer or a lower molecular weight homopolymer. The blending or dispersion resin can be used to reduce viscosity and material cost.

The resin system (material B) is well known in the art and includes thermoplastic homopolymers and copolymers derived from vinyl chloride alone or a combination with vinylidene chloride, vinyl acetate or other ester of vinyl alcohol.

Examples of suitable resins would be the homopolymer Exon 654 made by Firestone Tire & Rubber Company (a